

Appl. No. 10/782,486
Amdt. Dated 09/15/2005
Reply to Office Action of July 1, 2005

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) A multi-stage intensifier adapted for a fluid injector comprising:
- a fluid injection pump piston adapted to pressurize injection fluid when moved in a first direction;
 - a first intensifier piston positioned to apply force to the fluid injection pump piston in the first direction responsive to the pressure of an actuating fluid against an effective area of the first intensifier piston;
 - a second intensifier piston positioned to apply force to the fluid injection pump piston in the first direction responsive to the pressure of an actuating fluid against an effective area of the second intensifier piston; and,
 - a control valve coupled to selectively apply actuating fluid pressure to any of at least two of:
 - i) the effective area of the first intensifier piston,
 - ii) the effective area of the second intensifier piston, and
 - iii) the effective area of both the first and second intensifier pistons.

Claims 2-3 (Canceled)

4. (Currently Amended) The multi-stage intensifier of claim [[2]] 1, wherein the control valve comprises two, two-position, three-way valves.

5. (Original) The multi-stage intensifier of claim 1, wherein the first and second intensifier pistons are coupled together and wherein the control valve is coupled to selectively apply actuating fluid pressure to any one of:
- i) ~~the effective area of the first intensifier piston,~~

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- ii) ~~the effective area of the second intensifier piston, and~~
- iii) ~~the effective area of both the first and second intensifier pistons.~~

6. (Original) The multi-stage intensifier of claim 5, wherein the control valve comprises two, two-position, three-way valves.

7. (Original) The multi-stage intensifier of claim 6, wherein the three-way valves are magnetically latchable spool valves using residual magnetism.

8. (Currently Amended) The multi-stage intensifier of claim 1, wherein the actuating fluid is selected from the group consisting of fuel, engine oil and hydraulic fluid and the injection fluid is fuel.

9. (Currently Amended) A fluid injector having a multistage intensifier comprising:
an injector adapted to inject fluid responsive to the pressurization of an injection fluid;
a fluid injection pump piston adapted to pressurize injection fluid when moved in a first direction;

a first intensifier piston positioned to apply force to the fluid injection pump piston in the first direction responsive to the pressure of an actuating fluid against an effective area of the first intensifier piston;

a second intensifier piston positioned to apply force to the fluid injection pump piston in the first direction responsive to the pressure of an actuating fluid against an effective area of the second intensifier piston; and,

a control valve coupled to selectively apply actuating fluid pressure to any of at least two of:

- i) the effective area of the first intensifier piston,
- ii) the effective area of the second intensifier piston, and
- iii) the effective area of both the first and second intensifier pistons.

Claims 10-12 (Canceled)

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13. (Currently Amended) A method of operating a fuel injector having a multi-stage intensifier, comprising:

providing a fuel injection pumping piston adapted to pressurize injection fuel when hydraulically moved in a first direction;

providing a first effective area of the multi-stage intensifier responsive to an actuating fluid pressure to move the injection fuel pumping piston in the first direction;

providing a second effective area of the multi-stage intensifier responsive to an actuating fluid pressure to move the injection fuel pumping piston in the first direction, the first and second effective areas being unequal areas;

selectively providing actuating fluid under pressure to the first effective area or the second effective area or ~~The method of claim 10, further comprising selectively and~~
simultaneously providing actuating fluid under pressure to the first and second effective areas to
~~further-selectively~~ pressurize injection fuel by the injection fuel pumping piston.

14. (Original) The method of claim 13, wherein selectively providing actuating fluid under pressure to the first effective area, the second effective area, and both the first and second effective areas comprises providing actuating fluid under pressure using two, two-position, three-way valves.

15. (Canceled)

16. (Currently Amended) The method of claim ~~10~~13, wherein the actuating fluid is selected from the group consisting of fuel, engine oil and hydraulic fluid.